Component of Statistics Canada Catalogue no. 82-003-X
Health Reports

Article

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October 2009

Statistics Canada Statistique Canada

Canada

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Abstract

Background

In Canada, the prevalence of behavioural risk factors and chronic conditions differs for Aboriginal and non-Aboriginal populations, but little research has examined changes over time. This study compares several major risk factors and chronic conditions in Aboriginal and non-Aboriginal populations not living on reserves in the North (Yukon, Northwest Territories, Nunavut) and in southern Canada at two time points.

Data and methods

The data are from cycle 1.1 (2000/2001) and cycle 3.1 (2005/2006) of the Canadian Community Health Survey. 115,990 respondents aged 20 or older, and 118,716 respondents, respectively. Overall, 3.8% of respondents reported Aboriginal cultural or racial background. Crude prevalence estimates, adjusted odds ratios, and bootstrap-derived confidence intervals were calculated for seven risk factors and nine chronic conditions at each time point.

Results

In 2000/2001, Aboriginal people in the North were more likely than those in southern Canada to be obese, smoke daily and have infrequent physical activity, but less likely report a number of chronic conditions. Between 2000/2001 and 2005/2006, the odds of reporting risk factors increased among Aboriginal people in the North, and differences in the prevalence of chronic diseases were less pronounced. Few differences between non-Aboriginal respondents in the North and in southern Canada were observed.

Interpretation

Compared with southern Canada, the profile of health is changing more rapidly for Aboriginal than non-Aboriginal populations in the North, and appears to be worsening for the former.

Keywords

chronic disease, drinking behaviour, exercise, health surveys, morbidity, obesity, smoking

Authors

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In Canada, the prevalence of behavioural risk factors and chronic conditions varies between Aboriginal and non-Aboriginal populations, with Aboriginal people generally having less favourable outcomes. For example, obesity and overweight are more common among Aboriginal people than among other groups.[1-3] Also, the likelihood of having at least one chronic condition and specific conditions such as cardiovascular disease and diabetes is higher among Aboriginal people, even when differences in socio-demographic characteristics are taken into account.[2,4]

Relatively little research has examined the health of Aboriginal people over time. This is particularly relevant for those in the North, who are experiencing rapid changes in their social, cultural and physical environments, which are likely to influence their health. For example, a recent study[5] found that the self-reported prevalence of having a chronic condition rose in the North since 2000/2001; an increase was also observed in southern Canada, but it was smaller. That study also found a decrease in physical activity and an increase in obesity among residents of the North. However, differences between Aboriginal and non-Aboriginal populations were not investigated, so it was not clear if these trends prevailed only among Aboriginal people or were common to all people in the North.

The purpose of the current study is to compare changes over time in several major behavioural risk factors and chronic conditions among Aboriginal and non-Aboriginal populations in the North and in southern Canada who were not living on reserves.

Methods

Data source and study design

The data are from cycle 1.1 (2000/2001) and cycle 3.1 (2005/2006) of Statistics Canada's Canadian Community Health Survey. This national survey collects information about health status, determinants of health, and use of the health care system in the provinces and the territories. The survey covers approximately 98% of

the Canadian population aged 12 or older. It excludes residents of reserves and other government-owned land, institutional residents, full-time members of the Canadian Forces, and all residents (military and civilian) of Canadian Forces bases.

Cycle 1.1 was conducted from September 2000 to November 2001. The number of respondents was 131,535, and the overall response rate was 84.7%. The response rate in southern Canada ranged from 82.0% in Ontario to 88.8% in Nova Scotia. In the North (Yukon, Northwest Territories, Nunavut), the overall response rate was 78.3%.

Cycle 3.1 was conducted from January 2005 to January 2006. The number of respondents was 132,947, and the overall response rate was 78.9%. The response rate in southern Canada ranged from 76.4% in Quebec to 85.7% in Newfoundland and Labrador. In the North, the overall response rate was 83.3%, ranging from 81.6% in Yukon to 87.7% in Nunavut.

All respondents aged 20 or older to cycles 1.1 and 3.1 were included in this analysis: 115,990 in 2000/2001 and 118,716 in 2005/2006. The University of Manitoba Health Research Ethics Board approved this research. Permission to access the data was obtained from Statistics Canada. All analyses were conducted within the secure environment of the Statistics Canada Research Data Centre at the University of Manitoba.

Study measures

To distinguish *Aboriginal* and *non-Aboriginal* respondents in cycle 1.1 (2000/2001), the survey asked: "People living in Canada come from many different cultural and racial backgrounds. Are you . . . ?" The list of options included "Aboriginal Peoples of North America (North American Indian, Métis, Inuit/Eskimo)." For this study, those who responded positively to this option were assigned to the Aboriginal category; all other respondents were assigned to the non-Aboriginal category. Respondents were assigned to the Aboriginal category regardless of whether they reported being Aboriginal singly or in combination with a non-Aboriginal background.

In cycle 3.1 (2005/2006), a new derived variable was used to determine whether respondents were Aboriginal or non-Aboriginal. This variable was derived from two other variables. From January to May 2005, information needed to derive this variable was collected using the question in which respondents reported their cultural or racial background: "Aboriginal (North American Indian, Métis, Inuit)" was on the list of answer categories. In June 2005, the approach was changed to make the Canadian Community Health Survey more consistent with the Census of Population and the Labour Force Survey. Respondents were asked directly, "Are you an Aboriginal person, that is, North American Indian, Métis or Inuit?" Before June 2005, respondents were able to report Aboriginal background in combination with other cultural or racial backgrounds, and they were assigned to the Aboriginal category regardless of whether they reported Aboriginal background singly or in combination with a non-Aboriginal background. Beginning in June 2005, respondents identifying themselves as Aboriginal were not asked the question about other cultural or racial backgrounds.

Respondents who indicated that they lived in Yukon, Northwest Territories or Nunavut were defined as residents of the *North*; all others were defined as southern Canada residents.

The outcome measures were obtained from five modules of the Canadian Community Health Survey: height and weight, smoking, alcohol use, physical activity, and chronic conditions. Because module content and question wording changed over time, careful attention was given to the selection of questions common to both cycle 1.1 and cycle 3.1.

Measures of behavioural risk factors were derived from the modules on height and weight, smoking, alcohol use, and physical activity. Data about height and weight were used to calculate body mass index (BMI) by dividing weight in kilograms by the square of height in meters. Two categories of excess weight, based on Canadian guidelines,[6] were defined: *overweight* (BMI 25.0 to 29.9) and *obese* (BMI 30.0 or more).

In the smoking module, respondents were asked whether they smoked daily, occasionally, or not at all. A single dichotomous variable of *daily smoking* (yes/no) was created.

Questions about the frequency of alcohol consumption were used to define mutually exclusive categories for type of drinker: regular, occasional, former, and never. Regular drinkers were respondents who reported that they had consumed alcohol at least once a month in the past 12 months. Occasional drinkers were those who consumed alcohol less than once a month in the past 12 months. Former drinkers had not consumed alcohol in the past 12 months, but reported ever having consumed alcohol. The data were used to create a dichotomous variable defined as *regular drinker* (yes/no). Respondents were also asked if they had consumed more than five drinks on a single occasion in the past 12 months, which was used as a measure of *heavy drinking*.[7]

The average monthly frequency of all physical activities that lasted at least 15 minutes during the three months before the date of the interview was used to assess participation in physical activity. Respondents were classified as participating in: regular physical activity if their average monthly frequency was 12 or more times (at least three times a week); occasional physical activity if their average monthly frequency was 4 to 11 times; and infrequent physical activity if their average monthly frequency was less than 4 times. These response categories were grouped to form a dichotomous variable: regular/occasional and *infrequent*.

Levels of physical activity were based on respondents' total daily energy expenditure during leisure time. Respondents were categorized as active (3.0 or more kilocalories per kilogram per day [kcal/kg/day]), moderately active (1.5 to 2.99 kcal/kg/day), or *inactive* (0 to 1.49 kcal/kg/day); the first two categories were combined. Leisure-time physical

activities included individual pursuits such as walking, running, swimming, fishing and gardening, and team sports such as ice hockey, basketball, volleyball and soccer.

In the *chronic conditions* module, respondents were asked if they had been diagnosed by a health professional with selected conditions. Dichotomous response variables (presence/absence) were defined for the following conditions: asthma, arthritis/rheumatism, bowel disorders, cancer, diabetes, emphysema/chronic obstructive pulmonary disease, heart disease, high blood pressure, and stroke. Cancer and emphysema/chronic obstructive pulmonary disease were reported too infrequently to yield reliable results for the North, and were, therefore, excluded. In addition, a dichotomous variable indicating the presence of *at least one chronic condition* was created; the conditions used to define this variable were: food allergies, other allergies, asthma, fibromyalgia, arthritis/rheumatism, high blood pressure, back problems, migraine headaches, chronic bronchitis, emphysema, chronic obstructive pulmonary disease, diabetes, epilepsy, heart disease, cancer, stomach or intestinal ulcers, urinary incontinence, bowel disorders, cataracts, glaucoma, thyroid condition, chronic fatigue syndrome, multiple chemical sensitivities, and any other long-term condition diagnosed by a health professional.

Analytical techniques

The percentage of respondents reporting each behavioural risk factor and chronic condition was calculated, along with 95% confidence intervals. Weighted multiple logistic regression, stratified by Aboriginal/non-Aboriginal, was used to test associations between residence in the North versus southern Canada and each of the risk factors and chronic conditions. Each model also included age group (20 to 44, 45 to 54, 55 to 64, 65 to 74, and 75 or older) and sex as covariates. The reference category was southern Canada. Data from cycles 1.1 and 3.1 were analyzed separately. Survey weights were used in all analyses; these weights ensure that the final estimates are representative of the surveyed populations of the North and southern Canada.

A bootstrap method was used to calculate 95% confidence intervals for the adjusted odds ratios.[8-10] The bootstrap method randomly samples with replacement from the original set of observations to obtain a sampling distribution for a population parameter (for example, odds ratio). SAS software, version 9.1, was used to conduct all analyses, and a significance level of α=.05 was adopted.[11] A SAS macro developed at Statistics Canada was used to calculate the bootstrap confidence

Table 1
Ethnicity, sex and age group of off-reserve respondents aged 20 or older to Canadian Community Health Survey, by region and survey cycle, and comparison with 2001 Census of Canada data for off-reserve populations

	North		Southern Canada	
	Number	Percentage distribution	Number	Percentage distribution
Canadian Community Health Survey, cycle 1.1 (2000/2001)	**2,074**	**100.0**	**113,916**	**100.0**
Ethnicity				
Aboriginal	866	41.8	3,089	2.7
Non-Aboriginal	1,174	56.6	109,850	96.4
Sex				
Men	1,029	49.6	51,972	45.6
Women	1,045	50.4	61,944	54.4
Age group				
20 to 34	764	36.8	26,794	23.5
35 to 44	569	27.4	25,489	22.4
45 to 54	401	19.3	21,768	19.1
55 or older	340	16.4	39,865	35.0
Canadian Community Health Survey, cycle 3.1 (2005/2006)	**2,166**	**100.0**	**116,550**	**100.0**
Ethnicity				
Aboriginal	810	37.4	4,142	3.6
Non-Aboriginal	1,340	61.9	109,777	94.1
Sex				
Men	1,072	49.5	52,655	45.2
Women	1,094	50.5	63,895	54.8
Age group				
20 to 34	771	35.6	27,386	23.5
35 to 44	518	23.9	21,363	18.3
45 to 54	434	20.0	19,582	16.8
55 or older	443	20.5	48,219	41.4
2001 Census of Canada	**44,885**	**100.0**	**21,629,755**	**100.0**
Ethnicity[†]				
Aboriginal	16,615	37.0	390,115	1.8
Non-Aboriginal	28,280	63.0	21,239,640	98.2
Sex				
Men	22,580	50.3	10,458,780	48.4
Women	22,305	49.7	11,170,985	51.6
Age group				
20 to 34	16,145	36.0	5,832,035	27.0
35 to 44	12,290	27.4	5,017,815	23.2
45 to 54	9,685	21.6	4,353,925	20.1
55 or older	6,775	15.1	6,425,980	29.7

† based on Aboriginal identity, which refers to those who reported identifying with at least one Aboriginal group (North American Indian, Metis or Inuit) and those who did not report Aboriginal identity, but reported themselves as Registered or Treaty Indian, and/or Band or First Nations member

Note: Because of missing data, percentages may not add to 100.

Sources: 2000/2001 and 2005/2006 Canadian Community Health Survey; 2001 Census of Canada

intervals; these were based on a total of 500 samples, as recommended by the software developers.

Results

Characteristics of study population

Among respondents aged 20 or older to cycle 1.1 (2000/2001) of the Canadian Community Health Survey who were not living on reserves, 2,074 resided in the North, and 113,916 in southern Canada (Table 1). The corresponding figures for cycle 3.1 (2005/2006) were 2,166 and 116,550.

In cycle 1.1, 41.8% of respondents in the North and 2.7% of those in southern Canada were Aboriginal; in cycle 3.1, the percentages were 37.4% and 3.6%, respectively. According to the 2001 Census,[12] 37.0% of residents of the North who did not live on reserves were Aboriginal; the figure for southern Canada was 1.8%.

In both survey cycles, approximately half of respondents in the North were male; in southern Canada, the percentage was around 45%. Census results show similar percentages of men and women in southern Canada.

Table 2
Crude prevalence of selected risk factors and major chronic conditions, by region and ethnicity, off-reserve population, Canada, 2000/2001 and 2005/2006

	North						Southern Canada					
	2000/2001			2005/2006			2000/2001			2005/2006		
		95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval	
	%	from	to	%	from	to	%	from	to	%	from	to
Aboriginal												
Risk factors												
Overweight	28.6	26.1	31.0	26.2	22.1	30.2	30.1	27.4	32.8	30.9	28.6	33.2
Obese	20.2	18.1	22.4	25.4	20.5	30.2	22.7	20.1	25.2	25.3	23.2	27.4
Daily smoker	52.5	50.0	55.0	50.2	45.7	54.8	45.4	42.4	48.4	36.2	33.7	38.6
Regular drinker	44.4	42.5	46.3	51.6	46.5	56.7	54.3	51.1	57.5	56.7	54.3	59.2
Heavy drinking	17.7	16.4	19.0	22.9	19.7	26.1	24.1	21.2	26.8	26.9	24.6	29.2
Infrequent physical activity	28.3	26.5	30.1	29.2	24.6	33.8	21.1	18.7	23.4	19.0	17.0	20.9
Inactive leisure time	52.7	50.5	55.0	58.0	53.0	63.1	49.2	46.4	51.9	47.1	44.5	49.6
Chronic conditions												
One or more chronic conditions	48.5	46.0	51.1	57.3	53.2	61.3	68.0	65.2	70.9	72.3	70.0	74.5
Arthritis	11.6	10.0	13.2	11.5	8.8	14.1	21.0	18.9	23.4	19.8	17.8	21.8
Hypertension	9.4	7.8	11.1	10.9	8.3	13.5	11.8	9.7	14.0	14.4	12.9	16.0
Asthma	6.1	4.9	7.4	6.3	4.0	8.5	13.1	11.0	15.3	10.7	9.2	12.1
Heart disease	5.1	3.9	6.2	2.7	1.3	4.1	4.5	3.3	5.8	4.9	3.9	5.8
Diabetes	3.2	2.1	4.3	3.8	2.2	5.4	6.4	5.1	7.7	6.4	5.3	7.4
Bowel disorder	1.7	0.8	2.6	2.6	0.9	4.4	2.3	1.5	3.1	5.3	4.2	6.3
Stroke	0.9	0.5	1.3	1.2	0.5	2.0	1.0	0.4	1.6	1.7	1.2	2.3
Non-Aboriginal												
Risk factors												
Overweight	28.8	26.0	31.5	34.0	30.9	37.1	26.9	26.5	27.3	33.7	33.3	34.2
Obese	18.5	15.9	21.0	21.1	18.3	23.9	12.3	12.0	12.5	15.6	15.2	15.9
Daily smoker	29.9	26.5	33.3	23.5	20.1	26.9	22.4	22.0	22.8	17.6	17.3	18.0
Regular drinker	65.3	62.0	68.5	66.8	63.0	70.5	61.0	60.5	61.4	64.3	63.8	64.7
Heavy drinking	36.1	33.0	39.2	38.5	34.8	42.2	45.8	45.4	46.2	43.0	42.5	43.4
Infrequent physical activity	19.2	16.5	22.0	18.5	15.9	21.1	21.6	21.2	22.0	18.0	17.7	18.3
Inactive leisure time	42.6	39.2	45.9	45.8	41.5	50.0	52.2	51.7	52.7	49.4	49.0	49.9
Chronic conditions												
One or more chronic conditions	61.6	58.1	65.1	62.2	57.8	66.5	66.4	65.9	66.8	69.7	69.4	70.3
Arthritis	13.7	12.1	15.4	14.9	12.5	17.3	17.2	16.9	17.5	18.5	18.2	18.8
Hypertension	9.4	7.6	11.2	11.3	9.3	13.2	14.4	14.1	14.7	17.0	16.7	17.3
Asthma	8.5	6.2	10.7	8.6	6.6	10.5	7.8	7.5	8.0	7.8	7.6	8.0
Heart disease	3.3	2.1	4.4	2.7	1.9	3.6	5.7	5.5	5.8	5.4	5.2	5.5
Diabetes	3.1	2.3	3.9	3.8	2.5	5.0	4.6	4.5	4.8	5.5	5.3	5.6
Bowel disorder	2.1	1.2	2.9	4.2	2.6	5.8	2.3	2.2	2.5	4.3	4.2	4.5
Stroke	0.3	0.0	0.7	0.5	0.2	0.8	1.2	1.1	1.3	1.2	1.1	1.3

Source: 2000/2001 and 2005/2006 Canadian Community Health Survey

Respondents in the North tended to be younger than those in southern Canada. As a percentage of the population aged 20 or older, in both survey cycles, about 37% of respondents in the North were younger than 35, compared with about 24% of those in southern Canada; the corresponding percentages from the 2001 Census were 36.0% and 27.0%.

Risk factors

In 2000/2001 and 2005/2006, crude prevalence rates of daily smoking, infrequent physical activity and inactive leisure time were higher among Aboriginal people in the North than among those in southern Canada (Table 2). By contrast, overweight, obesity, regular drinking and heavy drinking were more prevalent among Aboriginal people in southern Canada.

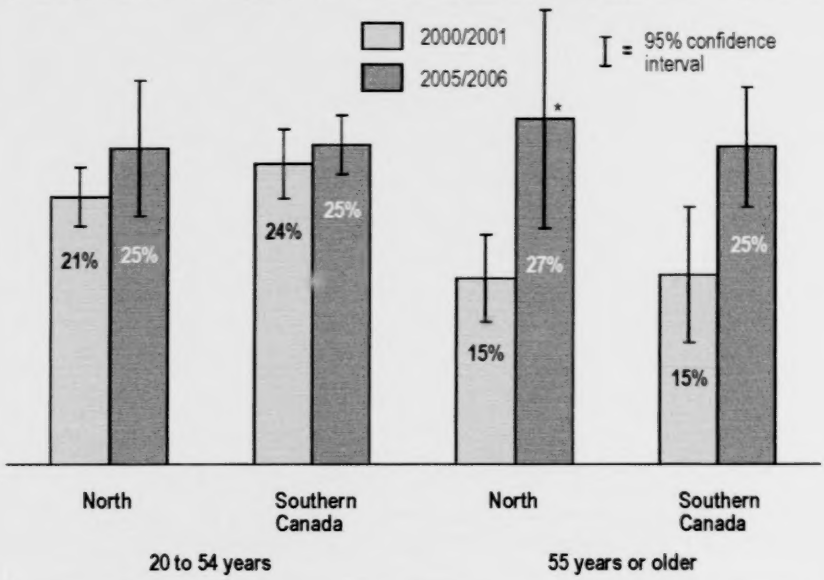
Among the non-Aboriginal population, overweight, obesity, daily smoking and regular drinking were more prevalent in the North than in southern Canada in 2000/2001 and 2005/2006.

From 2000/2001 to 2005/2006, the prevalence of obesity rose among all groups: Aboriginal and non-Aboriginal, in the North and in southern Canada (Table 2). However, among Aboriginal people, the largest increase was in the North (Table 2 and Figure 1).

During the same five-year period, the overall prevalence of daily smoking fell in all groups, but remained highest among Aboriginal people in the North (Table 2). The decrease in smoking prevalence among Aboriginal people was not statistically significant for those aged 20 to 54 in the North, although it was significant for their counterparts in southern Canada (Figure 2). At age 55 or older, smoking rates among Aboriginal people did not change significantly, regardless of where they lived.

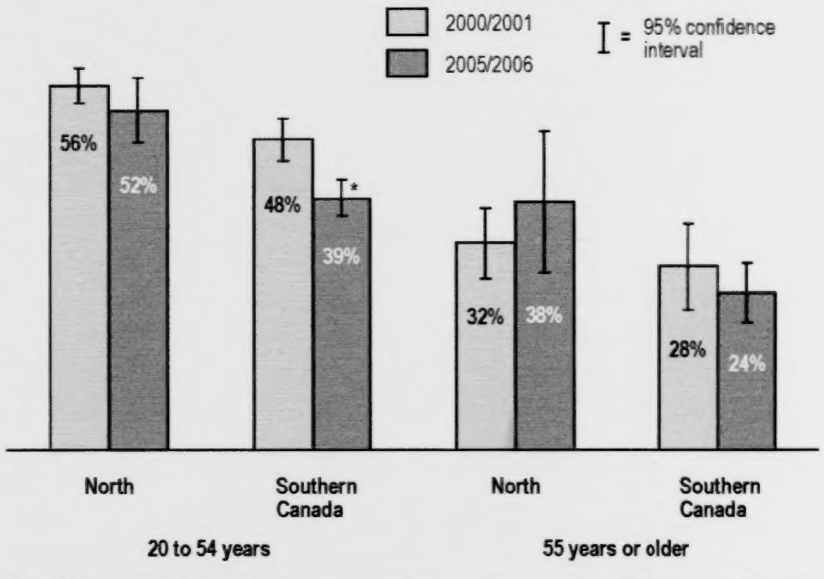
When the effects of the age and sex distributions of the various groups were taken into account, the odds of obesity, daily smoking, and infrequent physical activity were significantly higher for Aboriginal people in the North than for those in southern Canada (Table

Figure 1
Prevalence of obesity, by age group and region, Aboriginal off-reserve population aged 20 or older, Canada, 2000/2001 and 2005/2006



* significantly different from estimate for 2000/2001 ($p<0.05$)
Source: 2000/2001 and 2005/2006 Canadian Community Health Survey.

Figure 2
Prevalence of daily smoking, by age group and region, Aboriginal off-reserve population aged 20 or older, Canada, 2000/2001 and 2005/2006



* significantly different from estimate for 2000/2001 ($p<0.05$)
Source: 2000/2001 and 2005/2006 Canadian Community Health Survey.

Table 3
Age- and sex-adjusted odds ratios for selected risk factors and major chronic conditions for the North, by ethnicity, off-reserve population aged 20 or older, 2000/2001 and 2005/2006

	Aboriginal						Non-Aboriginal					
	2000/2001			2005/2006			2000/2001			2005/2006		
	Odds ratio	95% confidence interval		Odds ratio	95% confidence interval		Odds ratio	95% confidence interval		Odds ratio	95% confidence interval	
		from	to		from	to		from	to		from	to
Risk factors												
Overweight	1.00	0.85	1.18	0.83	0.66	1.05	0.93	0.81	1.08	1.03	0.89	1.19
Obese	1.30*	1.00	1.50	1.70*	1.30	2.20	1.30*	1.10	1.60	1.50*	1.20	1.70
Daily smoker	1.84*	1.57	2.14	3.20*	2.60	3.93	1.32*	1.12	1.55	1.33*	1.10	1.60
Regular drinker	0.81*	0.71	0.93	1.44*	1.14	1.81	1.00	0.86	1.18	1.04	0.87	1.23
Heavy drinking	0.80*	0.60	0.90	1.10	0.90	1.30	0.70*	0.60	0.80	1.00	0.80	1.10
Infrequent physical activity	1.21*	1.04	1.41	1.82*	1.40	2.37	0.92	0.77	1.09	1.14	0.96	1.35
Inactive leisure time	1.06	0.94	1.20	1.68*	1.35	2.11	0.68*	0.60	0.78	0.90	0.76	1.07
Chronic conditions												
One or more chronic conditions	0.50*	0.43	0.57	0.67*	0.55	0.82	0.85*	0.73	0.99	0.82	0.67	1.00
Arthritis	0.49*	0.40	0.60	0.65*	0.49	0.88	0.95	0.81	1.11	1.09	0.85	1.38
Hypertension	0.68*	0.52	0.89	0.86	0.62	1.18	0.75*	0.60	0.95	0.83	0.65	1.06
Asthma	0.49*	0.37	0.64	0.71	0.48	1.06	1.06	0.81	1.38	1.12	0.86	1.44
Heart disease	1.03	0.72	1.48	0.74	0.40	1.37	0.74	0.50	1.11	0.73	0.52	1.02
Diabetes	0.51*	0.34	0.78	0.75	0.45	1.25	0.83	0.62	1.10	0.87	0.59	1.29
Bowel disorder	0.80	0.41	1.57	0.61	0.29	1.28	0.89	0.56	1.41	1.06	0.70	1.59
Stroke	0.70	0.35	1.43	1.02	0.45	2.30	0.36	0.02	7.57	0.57	0.27	1.23

* significantly different from estimate for reference category ($p<0.05$)
Note: Reference category is the southern Canada population.
Source: 2000/2001 and 2005/2006 Canadian Community Health Survey

3). Moreover, these associations were stronger in 2005/2006 than they had been five years earlier.

In 2000/2001, the odds of regular drinking and heavy drinking among Aboriginal people were significantly lower in the North than in southern Canada. However, by 2005/2006, the odds of regular drinking were significantly higher among Aboriginal people in the North, and their odds of heavy drinking did not differ significantly from those of Aboriginal people in southern Canada.

In both 2000/2001 and 2005/2006, non-Aboriginal people in the North had significantly higher odds of obesity and daily smoking than did those in southern Canada. In 2000/2001, the odds of heavy drinking and inactive leisure time were significantly lower among non-Aboriginal people in the North than among those in southern Canada, but by 2005/2006, the differences were not statistically significant.

Chronic conditions

In 2000/2001 and 2005/2006, the crude prevalence of having at least one chronic condition, arthritis, diabetes and hypertension was higher in southern Canada than in the North among both Aboriginal and non-Aboriginal people (Table 2).

When the effects of the age and sex distribution of the population were taken into account, the odds of having one or more chronic conditions, arthritis, asthma, diabetes, and hypertension were significantly lower among Aboriginal people in the North than in southern Canada in 2000/2001 (Table 3). However, by 2005/2006, significantly lower odds were observed only for having one or more chronic conditions and arthritis; the odds ratios for the other chronic conditions were not statistically significant.

Non-Aboriginal people in the North had significantly lower odds of having one or more chronic conditions in 2000/2001, but not in 2005/2006. This group also had significantly lower odds of hypertension in 2000/2001, but again, the odds were not statistically significant in 2005/2006.

Discussion

This analysis of data from the 2000/2001 and 2005/2006 Canadian Community Health Survey reveals substantial differences in the prevalence of behavioural risk factors and chronic conditions between Aboriginal people living off a reserve in the North and in southern Canada; fewer differences were evident between Northern and southern non-Aboriginal people. As well, among residents of the North, over the five-year period, the extent of change in the odds ratios for the risk factors was greater among the Aboriginal than the non-Aboriginal population.

By 2005/2006, most of the differences in the prevalence of chronic conditions between Aboriginal people in the North

What is already known on this subject?

- On many measures of health, Aboriginal populations in Canada have less favourable outcomes than do non-Aboriginal populations.
- Aboriginal populations in the North are experiencing rapid change in their social, cultural, and physical environments.
- Relatively little is known about changes in the prevalence of risk factors and chronic conditions among Aboriginal and non-Aboriginal populations in the North, compared with those in southern Canada.

What does this study add?

- Differences in self-reported measures of obesity, smoking, drinking, and physical activity between Aboriginal populations in the North and in southern Canada were significant.
- Changes from 2000/2001 to 2005/2006 indicate a growing gap between the two groups on many risk factors.
- In 2000/2001, Aboriginal people in the North were less likely than those in southern Canada to report specific chronic conditions, including arthritis, hypertension, asthma and diabetes, as well as having one or more chronic conditions. By 2005/2006, this was true only for arthritis and having one or more chronic conditions.
- By comparison, there were fewer differences between non-Aboriginal people in the North and in southern Canada, and less evidence of a widening gap over time.

and those in southern Canada were no longer statistically significant.

The study results suggest a widening gap in the prevalence of behavioural risk factors between Aboriginal populations in the North and in southern Canada, and a narrowing gap between the two populations in the prevalence of some major chronic conditions. This may be preliminary evidence of the effect that the change in their behavioural risk factor profile is having on the health of Aboriginal people in the North.

The differences in the prevalence of behavioural risk factors and chronic conditions between Aboriginal and non-Aboriginal populations in the North and in southern Canada may be associated with a number of circumstances and characteristics, including access to and use of health services; knowledge, attitudes and beliefs about health; social determinants; and genetic predisposition.

Access to and use of the health care system, particularly in remote areas, may affect the detection and diagnosis of chronic diseases and the uptake of primary prevention services. For example, despite Canada's universal health care system, research has revealed variations in rates of use of primary care and specialist services by ethnicity[13] and between Aboriginal and non-Aboriginal groups,[14,15] even among those with chronic conditions whose need for health care should be consistently high.

Awareness of health risks, for example, of obesity, inactivity and smoking, is associated with health determinants such as ethnicity, income and education.[16] Previous research also suggests the existence of differences in the genetic expression of some conditions, including multiple metabolic syndrome, which is characterized by a cluster of cardiovascular risk factors.[17]

Limitations

This study has a number of limitations. It relied on cross-sectional data collected at two time points to estimate change in behavioural risk factors and major chronic conditions rather than using repeated measurements of the same cohort to follow health trajectories.

The way in which the Aboriginal population was defined for this study should not be overlooked as a potential contributor to the fundings.[18,19] Canadian Community Health Survey data on cultural or racial background were used to distinguish Aboriginal and non-Aboriginal populations. By contrast, the Census of Canada collects information on Aboriginal identity as well as origin.[20] Aboriginal identity includes individuals who report that they identify with at least one Aboriginal group (North American Indian, Métis, Inuit), and also those who do not report an Aboriginal identity but do report themselves as a Registered or Treaty Indian and/or Band or First Nations member. Individuals who report an Aboriginal cultural or racial background may not report an Aboriginal identity.

Canadian Community Health Survey data are available only for people living off reserves. According to the 2001 Census of Canada, no Nunavut residents lived on reserves, nor did 90% of Yukon residents (70% of Aboriginal people and 96% of non-Aboriginal people). However, in the Northwest Territories, just over half (51%) of the total population (29% of Aboriginal people and 73% of non-Aboriginal people) did not live on reserves.[12] In southern Canada, 99.0% of the population (70.8% of Aboriginal people and 99.9% of non-Aboriginal people) did not live on reserves.

This analysis is limited to the categories, "Aboriginal" and "non-Aboriginal," although these groups are not homogeneous. Within Aboriginal populations, disease burdens and risk factors may vary among First Nations, Inuit, and Métis peoples.

The self-reported data on which this study is based may underestimate the prevalence of some behavioural risk factors, such as overweight, obesity and smoking, and overestimate the prevalence of physical activity.[21] As well, measures of overweight and obesity developed for European populations may not be appropriate for Aboriginal people,[22] especially the Inuit.[23] Leisure-time physical activity does not account for activity at work, at school or at home.

As noted above, the diagnosis of chronic diseases may be influenced by the availability and use of health care

services, a factor that was not investigated in this study. Low reported prevalence of chronic conditions may reflect not so much the absence of disease as the lack of a diagnosis. As well, chronic condition prevalence estimates obtained from survey data may not be consistent with estimates from other population-based sources. Lix et al.[24] found, for example, that agreement between survey and administrative data was greatest for diabetes and hypertension, but was much lower for arthritis and heart disease.

Conclusion

Despite these limitations, the Canadian Community Health Survey is a rich source of information for investigating behavioural risk factors, chronic conditions, and their correlates. Further analyses could explore the co-occurrence of multiple risk factors in Aboriginal and non-Aboriginal populations, their association with health determinants such as income, food security and health care use,[25] and potential causal models.[26] As well, data from more than one cycle could be combined[1,27,28] to achieve sufficient sample size to enable comparisons among Aboriginal groups across Canadian regions.

In summary, the health of Aboriginal populations in the North appears to be worsening, compared with those in southern Canada and with non-Aboriginal people in both regions. Given the potentially deleterious outcomes associated with behavioural risk factors and chronic conditions, population health surveillance will be important for Aboriginal populations in the North. ■

Acknowledgements

This research was supported by the Canadian Institutes of Health Research (CIHR) Team Grant "CIHR Team in Circumpolar Health Research" [CTP-79853] and the Canadian Arthritis Network [07-NAARI-04]. Dr. Lix is supported by a CIHR New Investigator Award and a Centennial Research Chair at the University of Saskatchewan.

References

1. Tremblay MS, Perez CE, Ardern CI, et al. Obesity, overweight and ethnicity. *Health Reports* (Statistics Canada, Catalogue 82-003) 2005; 16(4): 23-33.
2. Tjepkema, M. Adult obesity. *Health Reports* (Statistics Canada, Catalogue 82-003) 2006; 17(3): 9-25.
3. Vanasse A, Demers M, Hemiari A, Courteau J. Obesity in Canada: where and how many? *International Journal of Obesity* 2006; 30: 677-83.
4. Monsalve M, Thommasen H, Pachev G, Frohlich J. Differences in cardiovascular risks in the aboriginal and non-aboriginal people living in Bella Coola, British Columbia. *Medical Science Monitor* 2005; 11(1): 21-8.
5. Deering KN, Lix LM, Bruce S, Young TK. Chronic diseases and risk factors in Canada's northern populations: Longitudinal and geographic comparisons. *Canadian Journal of Public Health* 2009;100:14-7.
6. Office of Nutrition Policy and Promotion. Canadian *Guidelines for Body Weight Classification in Adults* (Catalogue H49-179/2003E) Ottawa: Health Canada, 2003.
7. Reynolds DL, Chambers LW, DeVillaer MR. Measuring alcohol abuse in the community: Consumption, binge-drinking, and alcohol-related consequences ("alcoholism"). *Canadian Journal of Public Health* 1992; 83: 441-7.
8. Rao JNK, Wu CFJ, Yue K. Some recent work on resampling methods for complex surveys. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1992; 18: 209-27.
9. Rust KF, Rao J. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 283-310.
10. Yeo D, Mantel H, Liu TP. Bootstrap variance estimation for the National Population Health Survey. *Proceedings of the Annual Meeting of the American Statistical Association, Survey Research Methods Section, August 1999*. Baltimore: American Statistical Association, 1999.
11. SAS Institute, Inc. *SAS/STAT User's Guide, Version 9*. Cary, North Carolina: SAS Institute, Inc., 2004.
12. Statistics Canada. 2001 Census of Canada . *Aboriginal Identity Population, Registered Indian Status, Age Groups,Sex, and Area of Residence for Population, for Canada Provinces and Territories, 2001 Census – 20% Sample Data* (Catalogue 97F0011XCB2001005). Available at: http://www12.statcan.ca/english/census01/products/standard/themes/. Accessed August 17, 2009.
13. Quan H, Fong A, DeCoster C, et al. Variation in health services utilization among ethnic populations. *Canadian Medical Association Journal* 2006; 174: 787-91.
14. Gao S, Manns BJ, Culleton BF, et al. Access to health care among status Aboriginal people with chronic kidney disease. *Canadian Medical Association Journal* 2008; 179: 1007-12.
15. Jette N, Quan H, Faris P, et al. Health resource use in epilepsy: Significant disparities by age, gender, and aboriginal status. *Epilepsia* 2008; 49: 586-93.
16. Ho C-S, Tsai AC. Prevalence of overweight and obesity and its associated factors in aboriginal Taiwanese: Findings from the 2001 National Health Interview Survey in Taiwan. *Asia Pacific Journal of Clinical Nutrition* 2007; 16: 572-9.
17. Young TK, Chateau D, Zhang M. Factor analysis of ethnic variation in the multiple metabolic (insulin resistance) syndrome in three Canadian populations. *American Journal of Human Biology* 2002; 14: 649-58.
18. Kaplan JB, Bennett T. Use of race and ethnicity in biomedical publication. *Journal of the American Medical Association* 2003; 289: 2709-16.
19. Ramiriz M, Ford MA, Stewart AL, Teresi JA. Measurement issues in health disparities research. *Health Services Research* 2005; 40: 1640-57.
20. Statistics Canada, 2006 Census. Ethnic origins, 2006 counts, for Canada, provinces and territories – 20% sample data (table). *Ethnocultural Portrait of Canada Highlight Tables* (Catalogue 97-562-XWE2006002). Available at: http://www12.statcan.ca/english/census06/data/highlights/ethnic/index.cfm?Lang=E. Accessed August 14, 2009.
21. Gorber SC, Shields M, Tremblay MS, McDowell I. The feasibility of establishing correction factors to adjust self-reported estimates of obesity. *Health Reports* (Statistics Canada, Catalogue 82-003-XPE) 2008; 19: 71-82.
22. Lear SA, Humphries KH, Frohlich JJ, Birmingham CL. Appropriateness of current thresholds for obesity-related measures among Aboriginal people. *Canadian Medical Association Journal* 2007; 177: 1499-505.
23. Young TK, Bjerregaard P, Dewailly E Risica PM, et al. Prevalence of obesity and its metabolic correlates among the circumpolar Inuit in three countries. *American Journal of Public Health* 2007; 97: 691-5.
24. Lix LM, Yogendran MS, Shaw SY, et al. Chronic disease case ascertainment from administrative data: Agreement with survey data. *Chronic Diseases in Canada* 2008; 29: 31-8.
25. Reading CL, Wein F. *Health Inequalities and Social Determinants of Aboriginal Peoples' Health*. Prince George, British Columbia: National Collaborating Centre for Aboriginal Health. Available at: http://www.nccah-ccnsa.ca/. Accessed August 17, 2009.
26. Ansari Z, Carson NJ, Ackland MJ, et al. A public health model of the social determinants of health. *Sozial- und Praventivmedizin* 2003; 48: 242-51.
27. Tjempkema M. Health care use among gay, lesbian and bisexual Canadians. *Health Reports* (Statistics Canada, Catalogue 82-003) 2008; 19(1): 53-64.
28. Thomas S, Wannell B. Combining cycles of the Canadian Community Health Survey. *Health Reports* (Statistics Canada, Catalogue 82-003) 2009; 20(1): 53-8.